

The background of the slide is a photograph of a vast ocean under a clear blue sky. A faint rainbow is visible on the left side of the image, arching over the water. The text is overlaid on this image in a white, serif font.

Mapping the Global Ocean Eddy Field Using a Wide Swath Altimeter

Lee-Lueng Fu

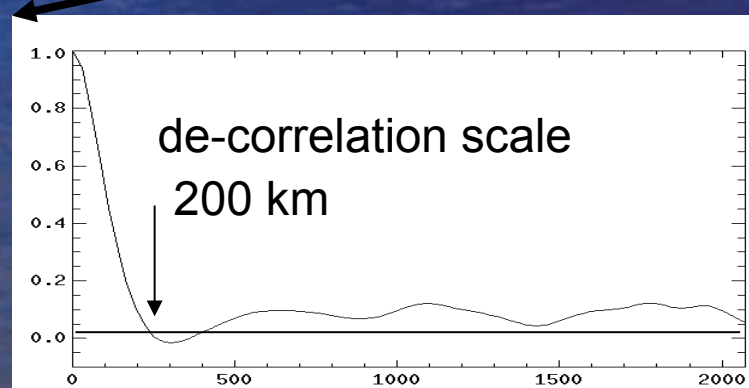
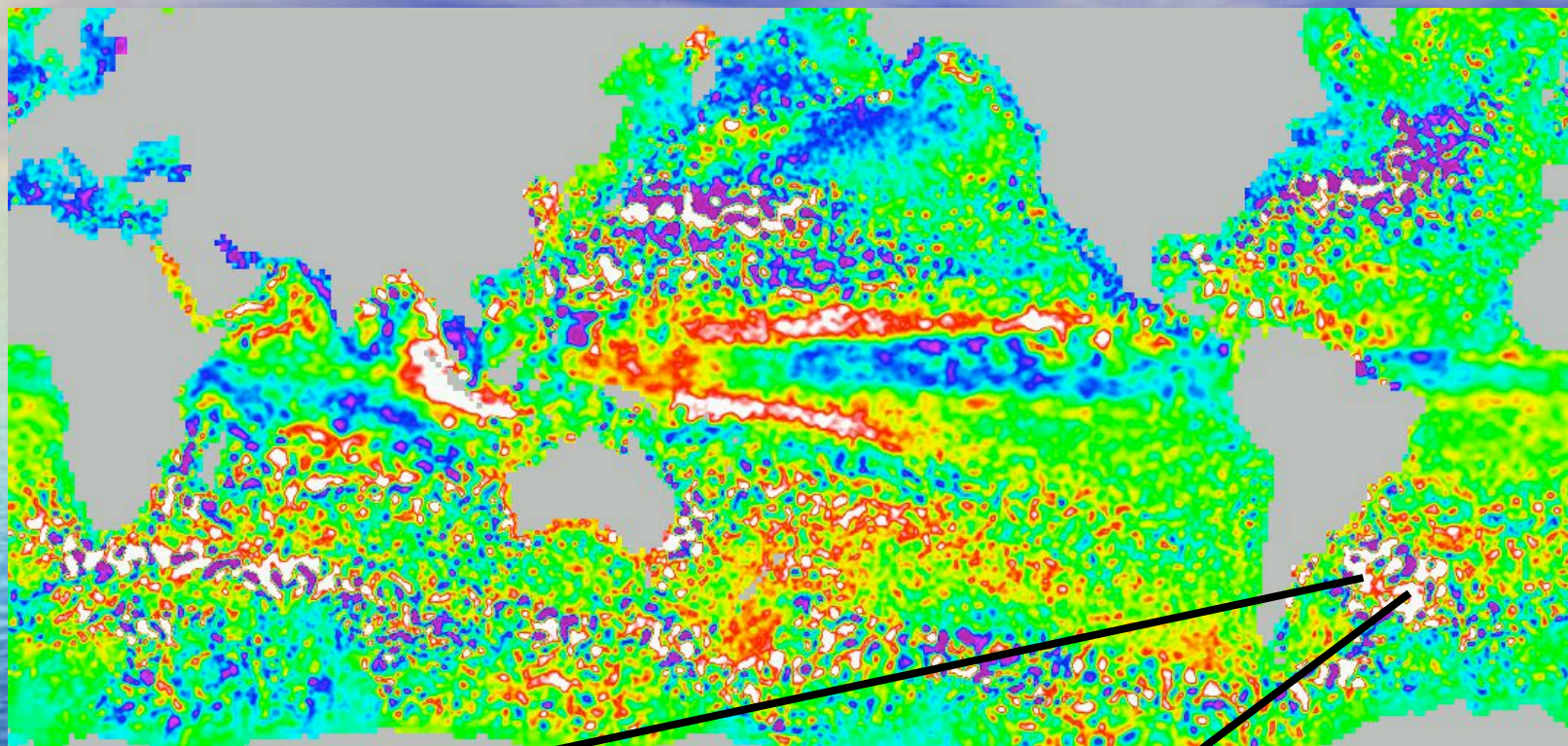
Jet Propulsion Laboratory

California Institute of Technology

Raffaele Ferrari

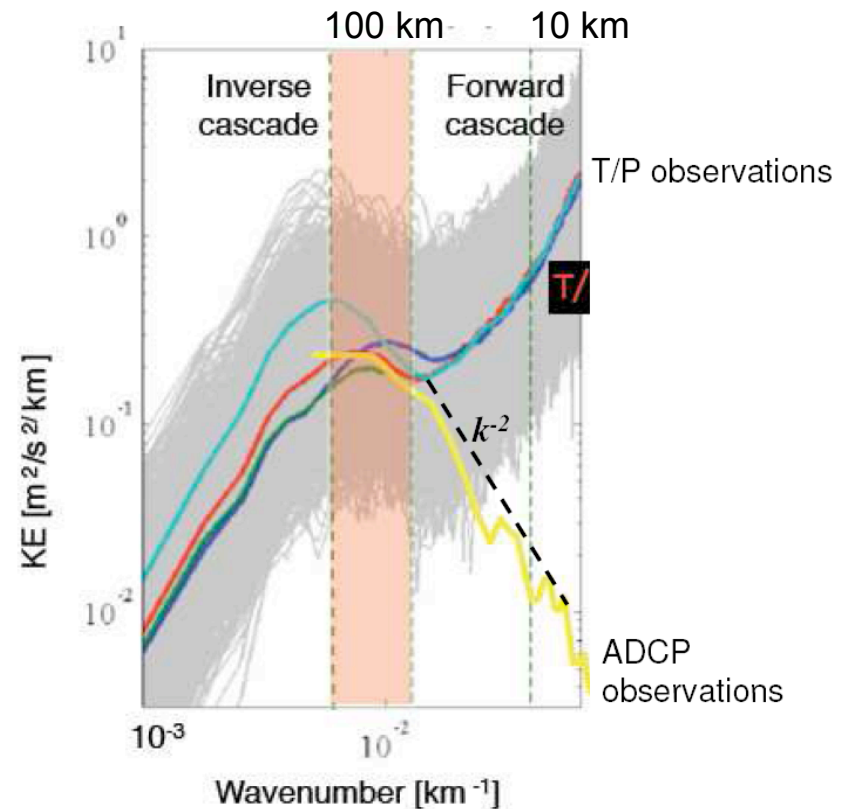
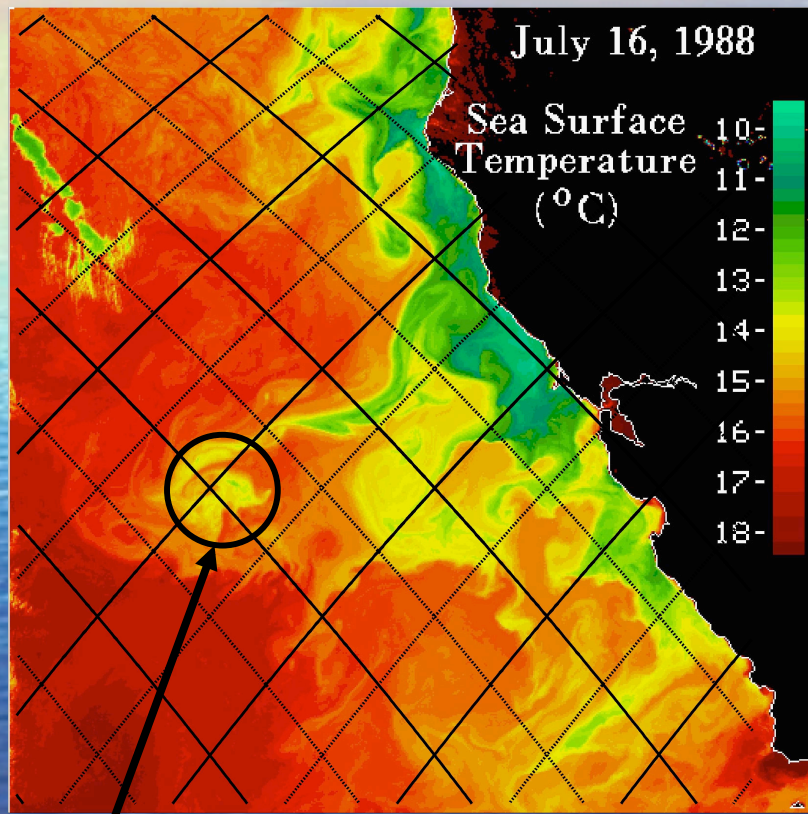
Massachusetts Institute of Technology

A snapshot of ocean eddies from merged Jason/Envisat data provided by CLS (the best existing data)

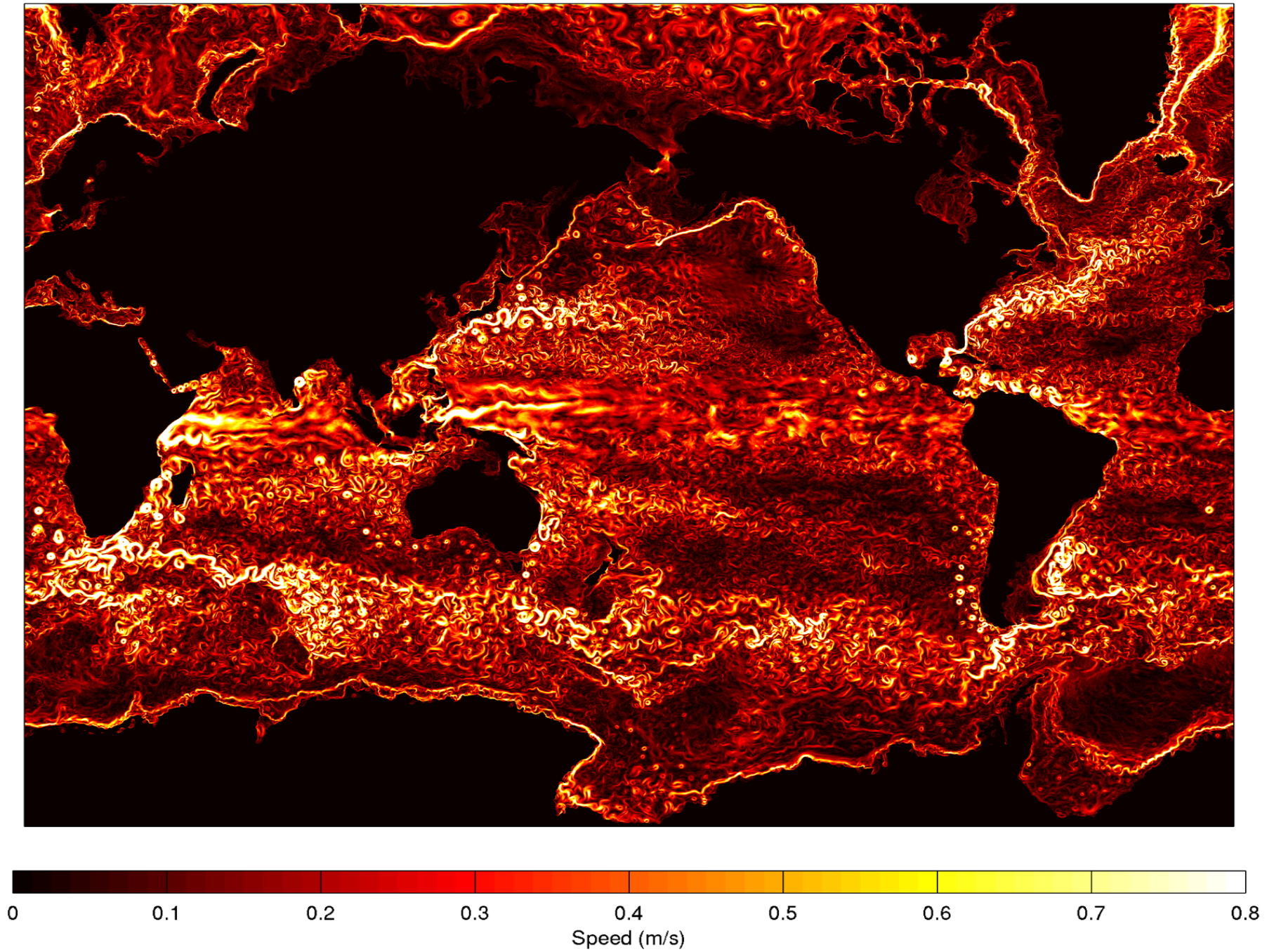


The ocean's kinetic energy resides in scales not well resolved by a nadir-looking altimeter

ground tracks of Jason (thick) and
T/P (thin) Tandem Mission



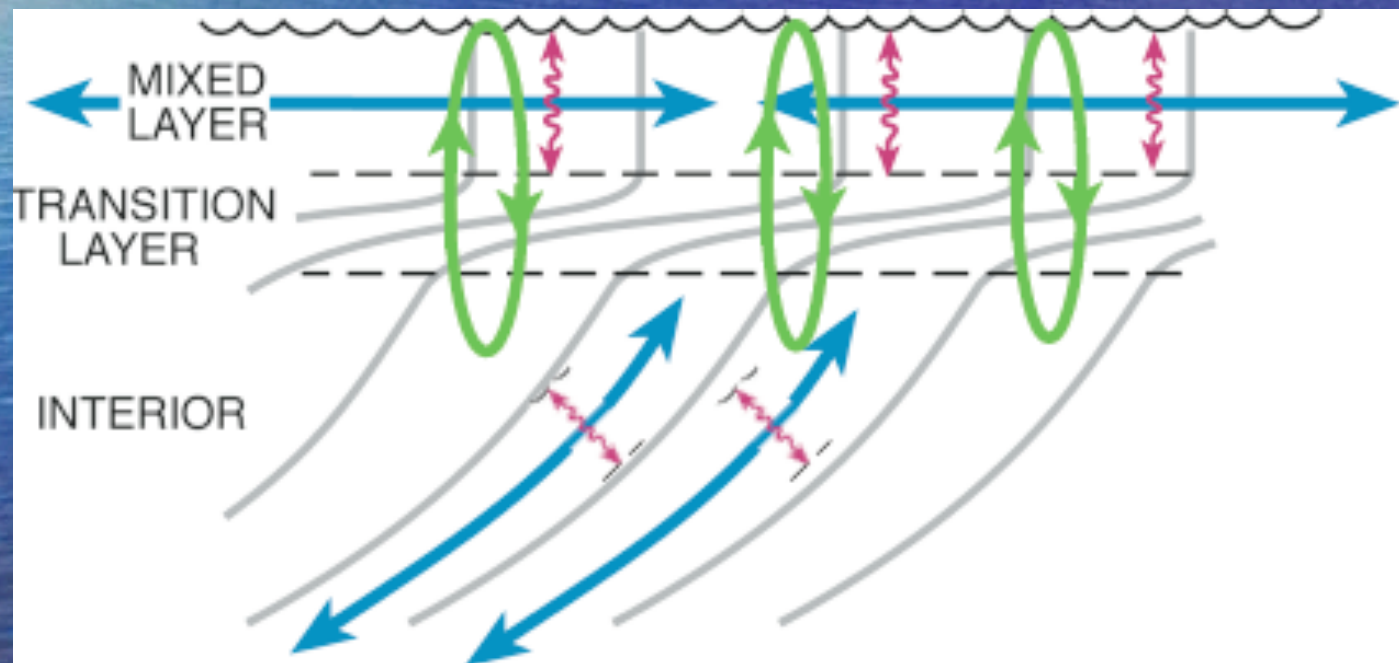
Ocean current speed at 15 m depth from 1/16th ECCO2 integration



The importance of oceanic submesoscales:

About 50% of the vertical motion in the world's oceans responsible for heat and CO₂ uptake takes place at the submesoscales

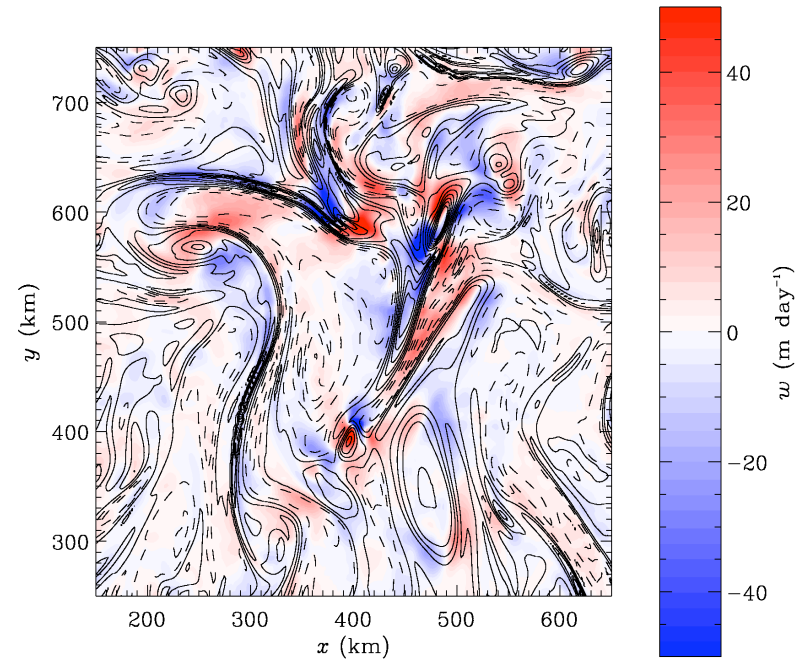
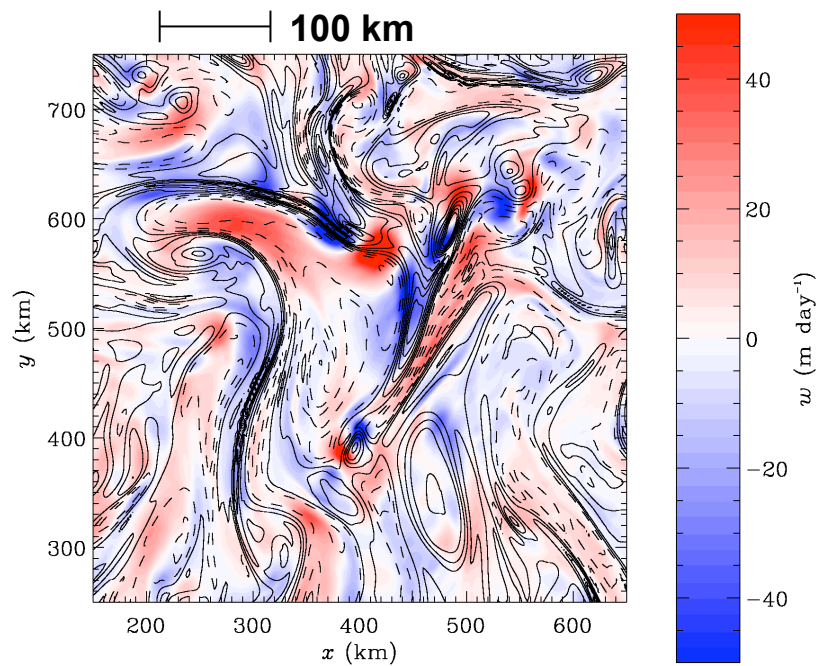
$$\bar{b}_t + \bar{\mathbf{u}} \cdot \nabla \bar{b} = - \underbrace{\nabla_H \cdot \overline{\mathbf{u}'_H b'}}_{\text{mesoscale}} - \underbrace{\partial_z \overline{w' b'}}_{\text{submesoscale}} + \underbrace{\partial_z \overline{\kappa b'_z}}_{\text{boundary layer}}$$



Estimating the vertical velocity of the upper ocean from SSH measurement

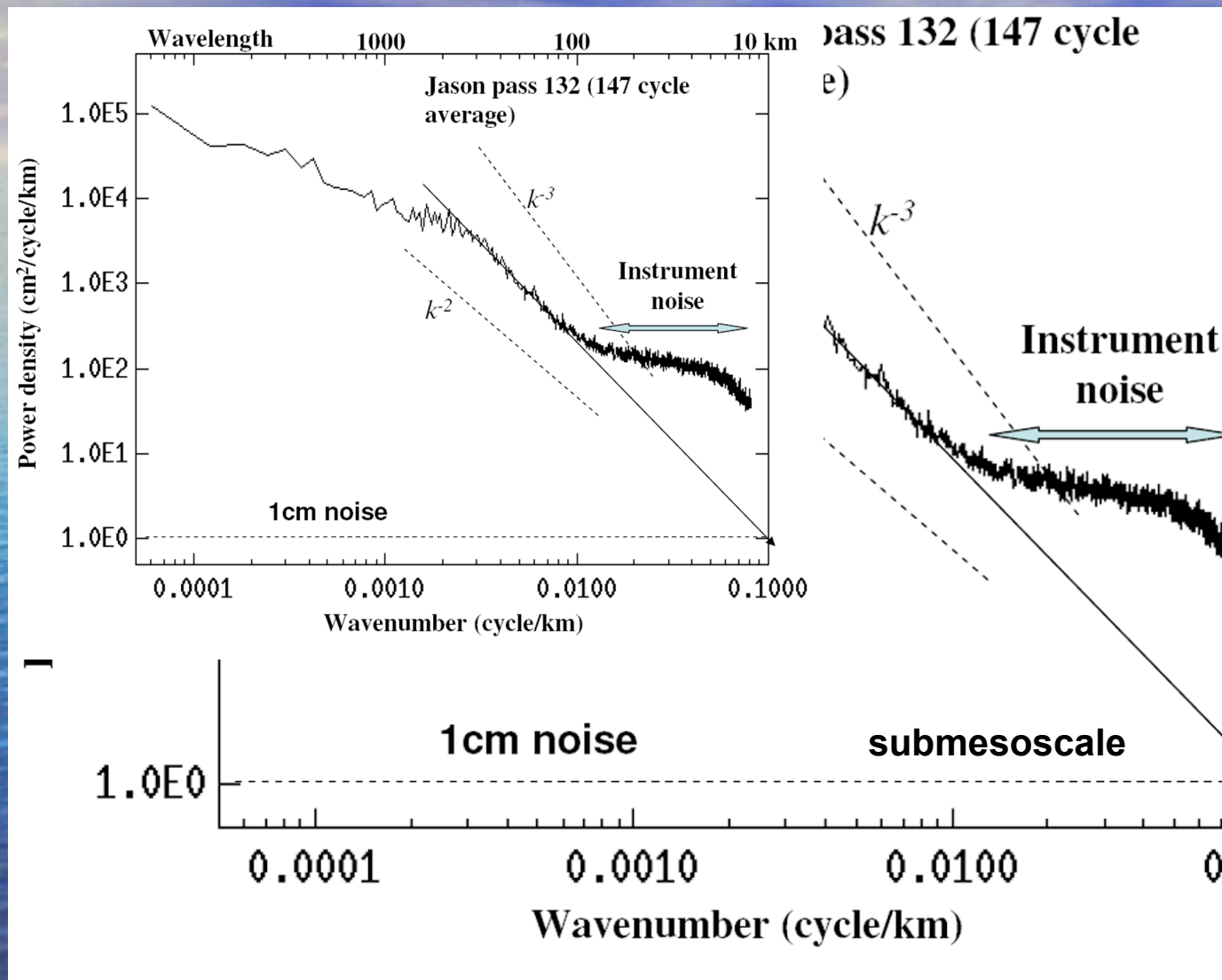
Simulated W by an OGCM

Reconstructed W from SSH



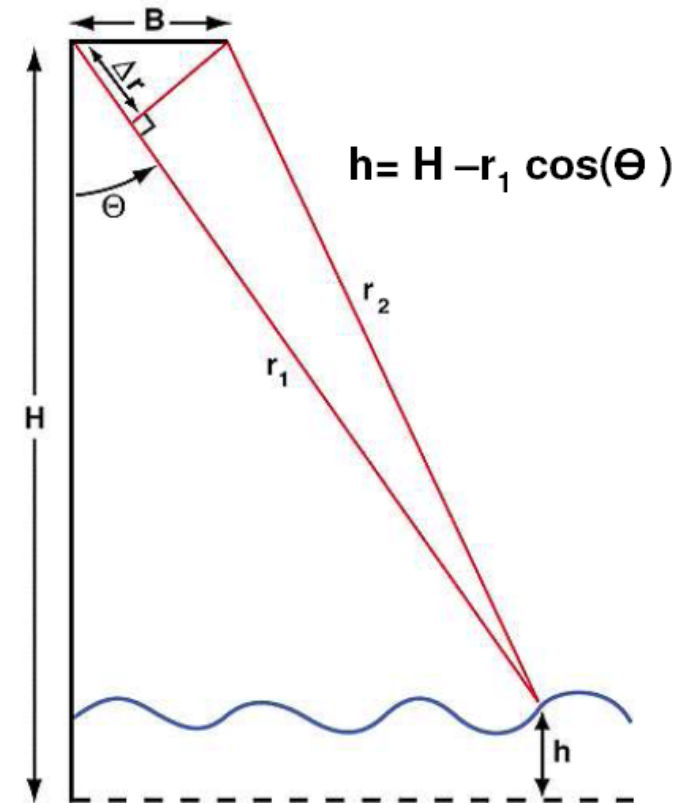
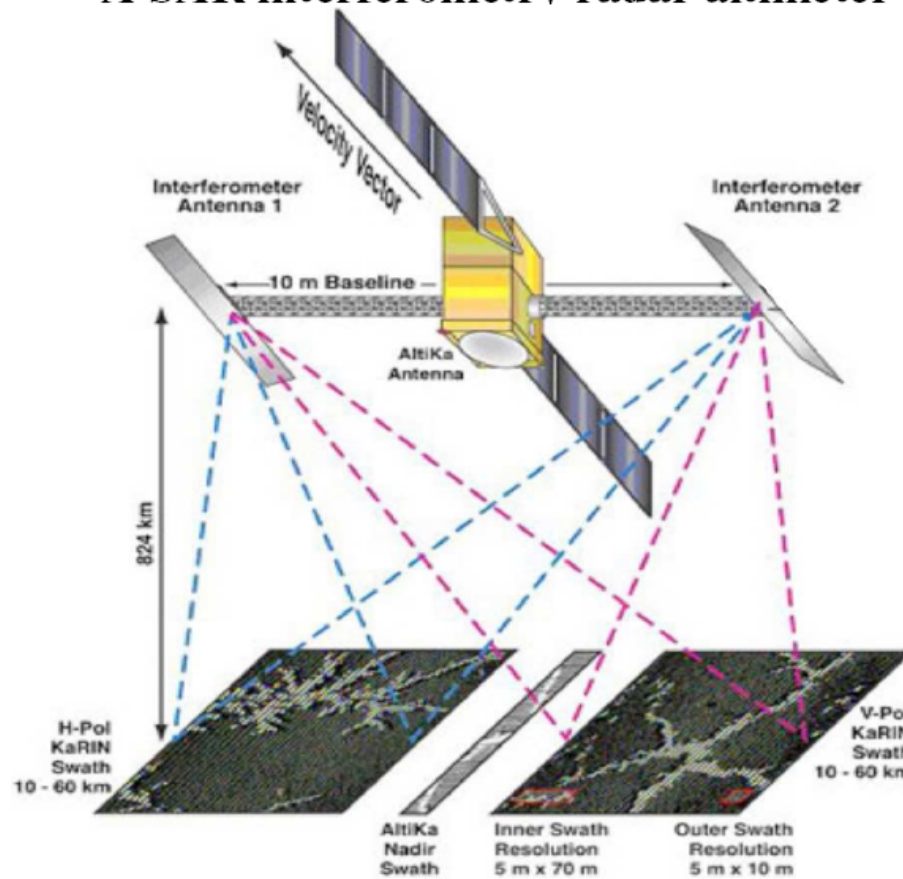
Contours are relative vorticity

The oceanic submesoscales have not been well observed

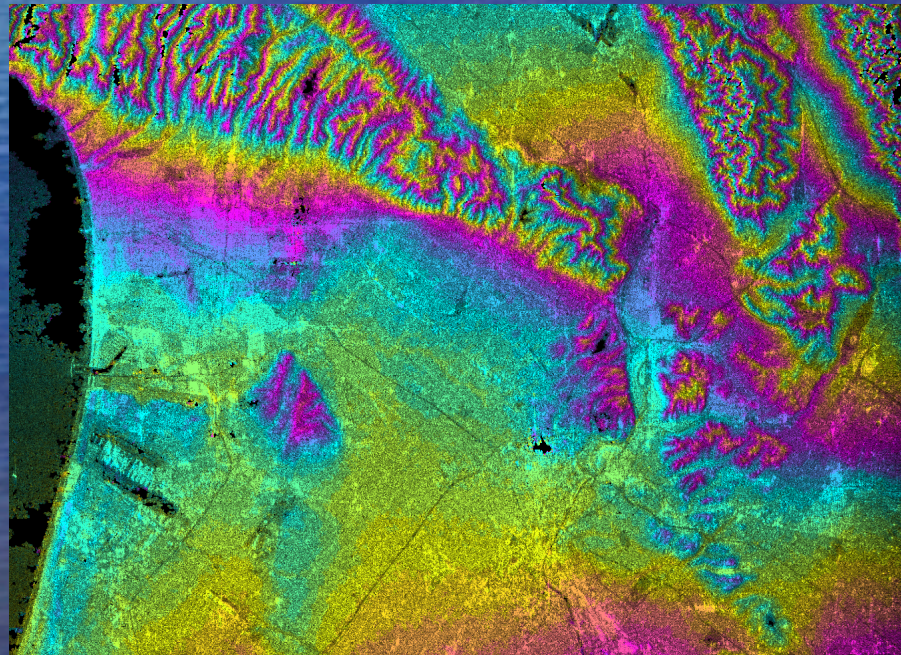
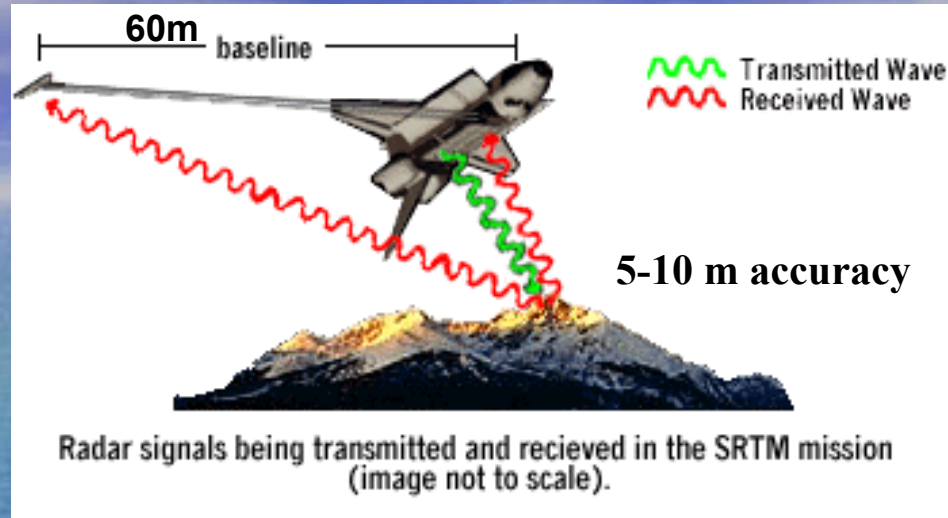


High-resolution wide-swath altimetry

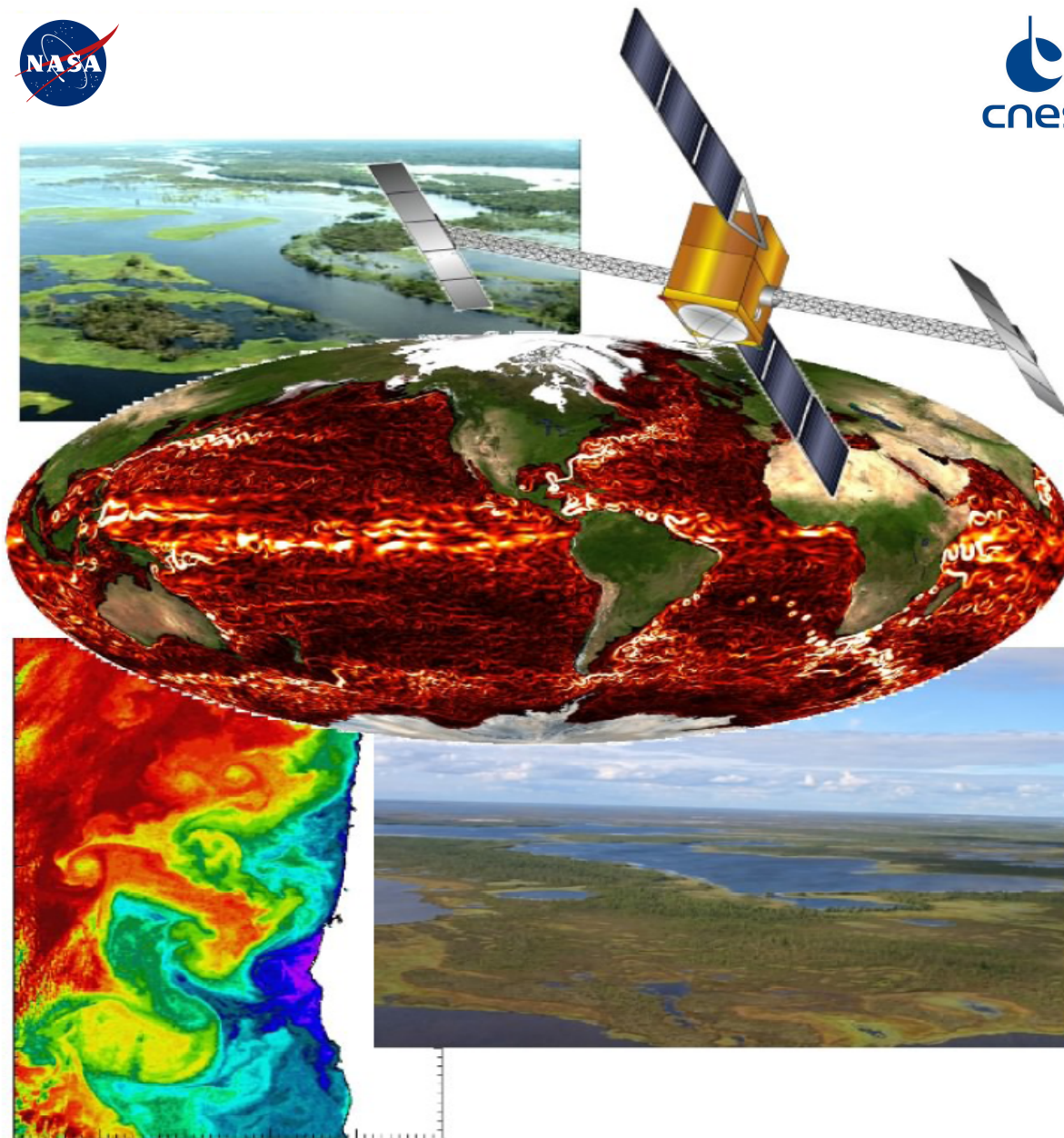
A SAR interferometry radar altimeter



Radar Interferometry was successfully demonstrated by JPL's Shuttle Radar Topography Mission (SRTM)



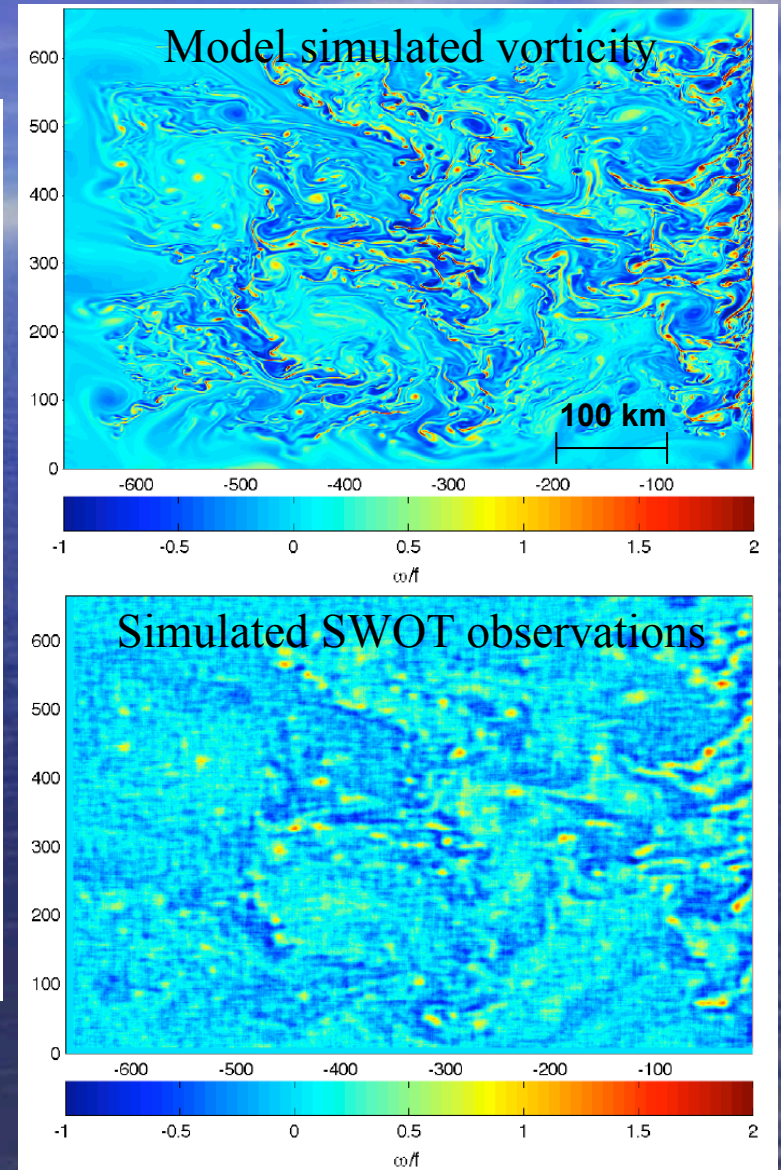
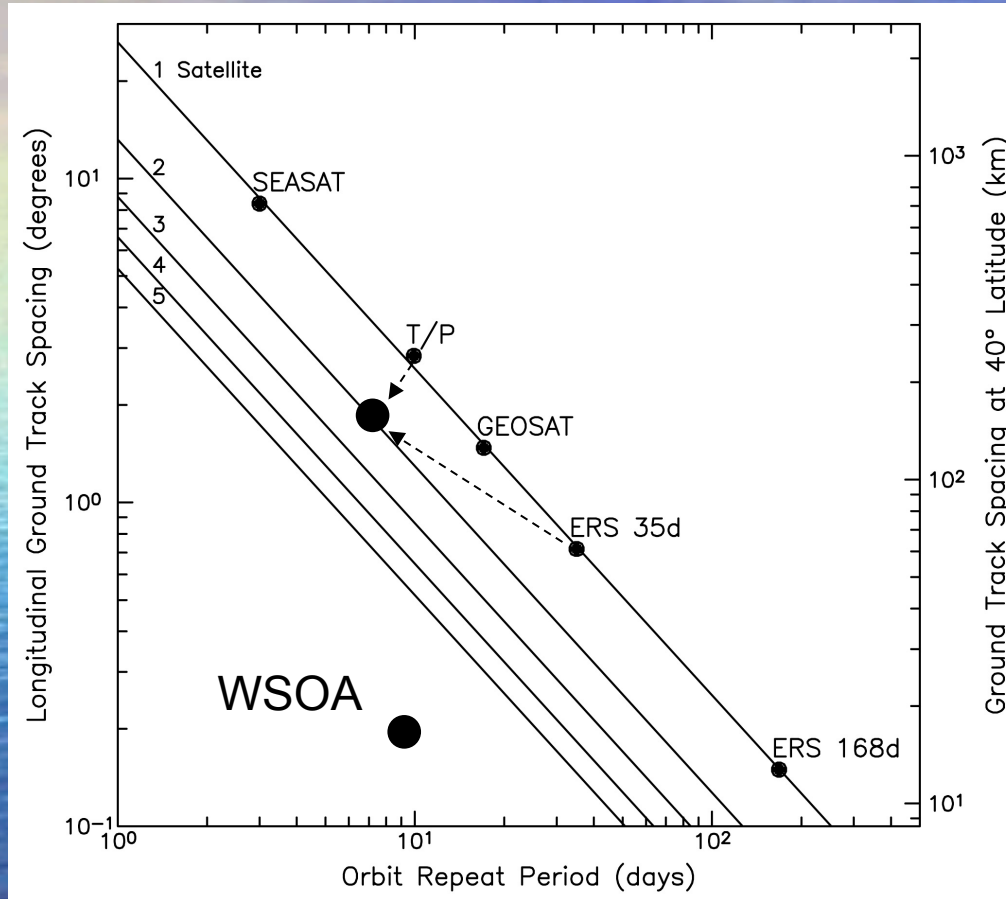
Surface Water and Ocean Topography Mission (SWOT)



- 10 m mast
- Ka Band (35 GHz)
- 3.5 deg look angle
- 120 km swath
- 22-day global coverage
- 2 obs/22days at the equator
- > 3 obs/22days at latitudes > 50 deg
- > 6 obs/22days at latitudes > 65 deg

Anticipated SWOT Performance

Space time sampling



Summary

- SAR interferometry offers a promising approach to mapping the global ocean eddy variability down to 10 km scale.
- Oceanic submesoscales are important for the kinetic energy of ocean circulation as well as the vertical transfer of heat, nutrients, and carbon to the deep ocean.
- The SWOT Mission is under development for addressing both oceanographic and hydrologic objectives.

Please come to the Town Hall meeting tonight at 6:15 pm, Moscone West, Room 2018 for more information on SWOT.